FRD ACTIVITIES REPORT
January - March 2009

RESEARCH PROGRAMS

EPA Roadside Sound Barrier Tracer Study

The Roadside Sound Barrier Tracer Study, conducted in 2008, was completed at the end of January. A comprehensive draft document and final quality controlled data were delivered on schedule at the end of January to the EPA. The draft document *Roadside Sound Barrier Tracer Study 2008* will be published as a NOAA Technical Memorandum and has already passed ARL review. It contains details of all phases of the work including the experimental design, construction of the barrier and sampling grids, tracer measurements made with bag samplers and fast response analyzers, standard meteorological and turbulence measurements, tracer line source release systems, and a section summarizing the results and presenting conclusions. The report provided the basis for two other papers that were submitted during the quarter (see ***Papers*** below). A summary of the roadway barrier study and the main conclusions of the research were previously presented in FRD's first quarter report for 2009. (Kirk.Clawson@noaa.gov and staff)

Low Cost Tracer Detector

During the summer and fall of 2008, a prototype tracer measurement instrument was assembled using an X-6 low cost detector and a semi-permeable membrane from Membrane Technology Inc. (module # 3966) with the intent of deploying it during the EPA Roadside Sound Barrier Tracer Study. On Oct. 7, 2008, the X-6 prototype instrument was calibrated in the laboratory. After calibration, it was mounted on a single piece of particle board so it would be more portable. A data acquisition system borrowed from a fast response analyzer was attached to the X-6 prototype. The prototype is shown in Fig. 1.

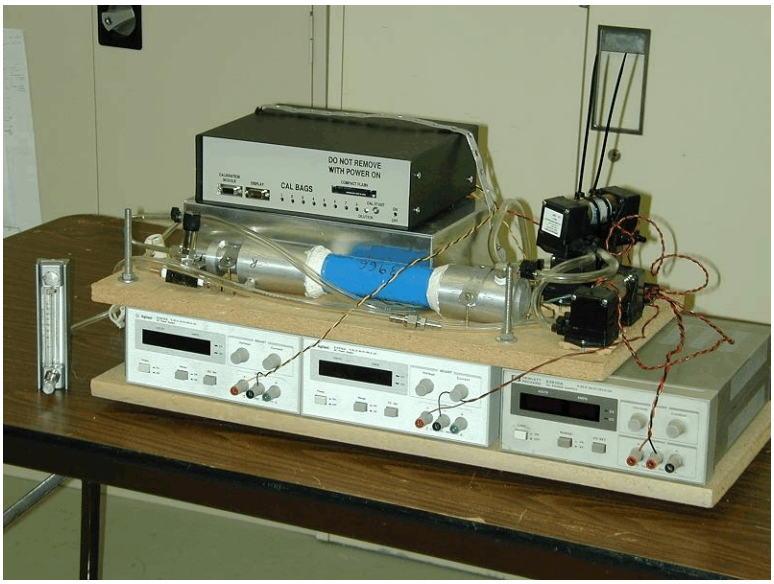

Figure 1. The X-6/Membrane prototype detector. The X-6 is in the silver box on the left rear. The membrane is in the blue cylinder.

On Oct. 24, 2008, the X-6 prototype was deployed during Test 5 of the EPA Roadside Sound Barrier Tracer Study. It was collocated with a bag sampler that

was collecting 15 minute air samples. The X-6 prototype was powered by a portable generator. It was started approximately one hour before the test and ran unattended during the test. The test was scheduled to start at 19:00 MDT, but the tracer release began about 20 minutes before that to ensure that the release lines were fully purged by 19:00. About 20:04 MDT, the data system on the X-6 prototype encountered an error and quit collecting data. The cause of the error was unknown.

The data collected by the X-6 prototype was corrected for data system effects, low pass filtered, and converted to concentrations using the Oct. 7 calibration curve. Figure 2 shows these concentrations scaled by 1.1 (a 10% increase) plotted along with the bag sampler results. There is reasonably good agreement between the measurements. The 10% increase in the X-6 concentrations improves the agreement slightly and probably indicates a 10% drift in instrument sensitivity between the Oct. 7 calibrations and the deployment 17 days later.

In spite of a rushed assembly and several problems, this demonstration field deployment showed that an instrument based on the X-6 and a semi-permeable membrane could be laboratory calibrated and then deployed to run unattended and make tracer measurements. It also demonstrated that a practical way of using the instruments may be to collocate them with bag samplers as was done here. The calibration on the X-6 instruments could then be adjusted so the measurements match the bag sampler results. This way, the bag samplers would provide the absolute tracer concentrations and the X-6 instruments would provide plume structure information. (Roger Carter@noaa.gov)

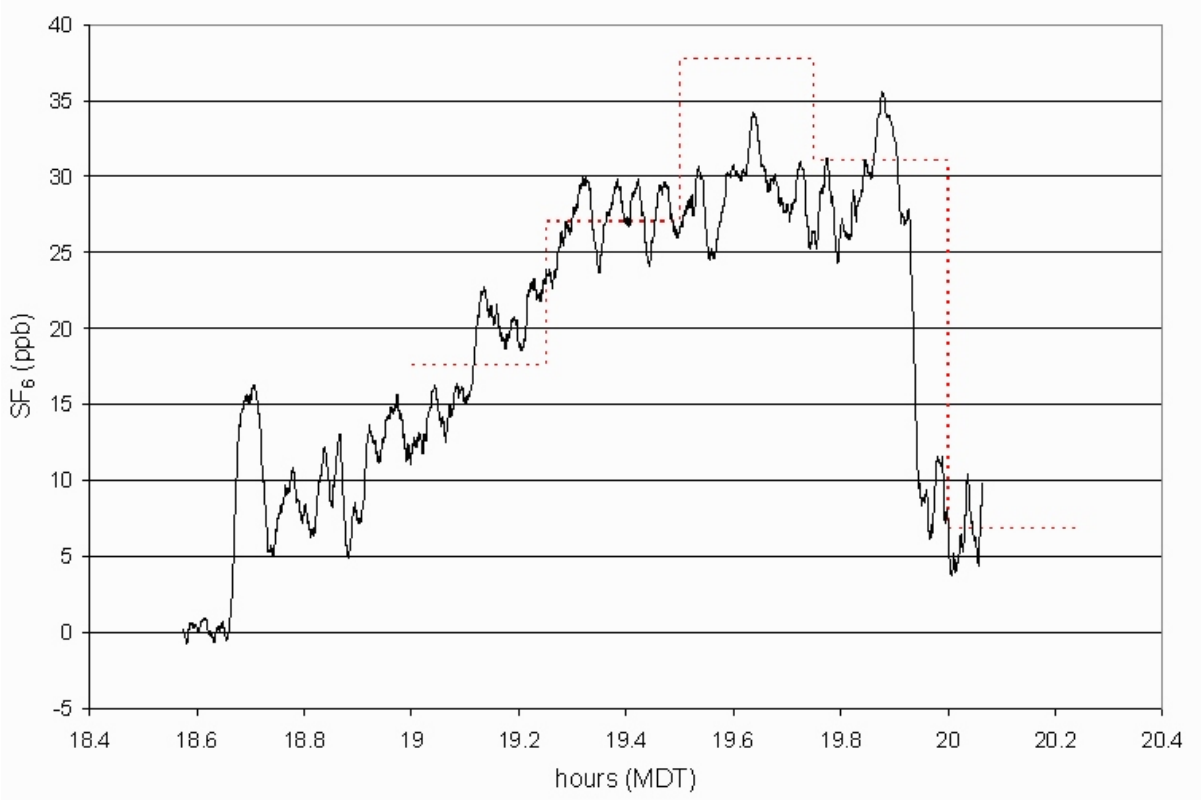

Figure 2. X-6 prototype data compared with the 15 minute average concentrations from a collocated bag sampler. The dotted line shows the bag sampler concentrations.

ET Probe

FRD has started upgrading the ET probes on the assumption that NOAA funding will be available once the budget has been approved. The primary focus is on design changes that will allow the probes to operate over extended deployments at marine locations. The pressure ports on the ET sphere have been made more robust by replacing the plastic tubing with metal tubing. In the 2004 hurricane deployments, the temperature housing at the top of the probe was a weak point, so the original housing has been replaced by a new one based on the housings used on the INL Mesonet towers. There has been some debate about the best approach for upgrading the probe's data acquisition system. Initially, it was thought that using a small computer that could fit inside the probe itself would be ideal. However, the drawback of this approach for marine deployments in hurricanes is that the computer and archived data are automatically lost if the probe is dislodged and falls into the water. Having the computer system in a separate housing increases the chances of recovering data even if the probe itself is lost. (Rick.Eckman@noaa.gov)

FRD is teaming with a professor at the University of Miami in submitting a proposal to the Office of Naval Research to develop a buoy-based ET probe. The university has special research buoys and plans to deploy them in the Pacific near Taiwan during the 2010 typhoon season. The team effort would involve building additional probes for use on the buoys. These buoys already have platform-motion sensors onboard, so there should be no need for FRD to add its own sensors. Of course, some effort will be required to integrate the ET computers with the existing buoy computers. A wind/wave tank that can simulate hurricane conditions is also available at the university and provides an opportunity to perform more controlled tests of the probe performance. The proposal deadline is 10 April. (Rick.Eckman@noaa.gov)

NOAA/IDAHO NATIONAL LABORATORY METEOROLOGICAL RESEARCH PARTNERSHIP

Emergency Operations Center (EOC)

Team A participated in their first EOC requalification drill of the year on January 21. The drill involved a train accident near the INL Research and Education facility. Two railroad cars were leaking ammonia. FRD provided plume trajectories, nowcasts, and short-term forecasts during the drill. (Jason.Rich@noaa.gov and Brad Reese)

Team B participated in a drill at the EOC on February 25th. The drill was intended to simulate the response to the spill of ammonia due to derailment of a tanker car near the Center for Advanced Energy Studies and University Place educational facilities in Idaho Falls. The ALOHA and MDIFF models were used to plot the trajectory of the plume and determine zones where airborne concentrations of ammonia exceeded safe limits. (Dennis.Finn@noaa.gov and Kirk Clawson)

Team D had a drill at the EOC on 4 March. It involved leaking propane tanks at Specific Manufacturing Capability (SMC) facility on the INL. The ALOHA model was used to estimate

both toxic concentrations and the potential blast area if the tanks exploded. (Rick.Eckman@noaa.gov and Randy Johnson)

New INL Hazardous Weather Alert System

The NOAA INL Weather Center issued three High Wind Statements during the last quarter. All three wind forecasts verified correctly by reaching the criteria level of at least 25 mph. The statements were issued on average of 55 minutes prior to each event. All three windy periods were caused by cold frontal systems or troughs moving across the area. (Neil.Hukari@noaa.gov)

Transport and Dispersion Modeling

A major effort started in the second quarter to develop a new dispersion modeling system for INL applications. This system will be based on the NOAA HYSPLIT model. Several members of the FRD staff are involved in the effort. The following entries describe some of the progress that has been made on specific features of the system. In some cases, other divisions in ARL have already developed software that may potentially meet FRD's needs, and this existing software is being adopted when possible. The plan is to have a prototype of the dispersion system working by the end of summer. (Rick.Eckman@noaa.gov and FRD staff)

One major goal of the effort to use HYSPLIT for INL applications is the inclusion of a more robust radiological module that can serve the needs of FRD's INL clients more effectively than is presently available within MDIFF. This has called for the development of code that can convert the "concentrations" (Ci/m^3) of multiple nuclides into multiple dose types in rem. Some significant development work on converting concentrations into rem for multiple dose types has already been done by Glenn Rolph and Roland Draxler in the ARL HYSPLIT group. They have also developed a prototype program for plotting the final doses. We have drawn heavily on their efforts and are using their prototype concentration-to-dose conversion and plotting programs as bases for our work. The main limitations of the existing prototypes with respect to our needs are (1) the concentration-to-dose program presently can only calculate doses for one nuclide concentration and (2) our INL clients have somewhat different plume contouring requirements than is presently available. We have re-written the concentration-to-dose program such that it can now calculate multiple doses using the individual contributions from multiple nuclides. We are in the process of making the necessary modifications to the dose plotting program to accommodate our specific contouring needs. The biggest improvements offered by the new radiological module compared to the previous MDIFF scheme are (1) accounting for the individual contributions of each nuclide to each type of dose when multiple nuclides are present and (2) deposition is now available and can be customized for each nuclide. (Dennis.Finn@noaa.gov and Jason Rich)

Another important facet of the work is development of the user interface for the INL client. Our initial emphasis is on developing the simplest and most user-friendly interface possible. Advanced options will be gradually be added to permit setting up more customized dispersion scenarios. Output will be produced using the Google Maps API. This will provide a dynamic environment for easy rescaling and the plotting of multiple dose types. Development of the user

interface and manipulation of the output will be written using the Flex programming environment. This will allow the application to run within the Adobe Flash browser plug-in. Work is presently focused on developing the software that builds the input-output interface, the control file for passing parameters into HYSPLIT and subsequent program modules, and the master control program. (Brad.Reese@noaa.gov, Dennis Finn, Jason Rich)

FRD has also been working with INL to provide our Mesonet data in formats required for regulatory requirements. INL is now using the EPA AERMOD model for certain applications and requested that FRD reformat the Mesonet data in a suitable form for that model. This turned out to be more difficult than anticipated, mainly because the 915 MHz radar wind profiler data turned out to be insufficient as a stand-alone vertical sounding for the model's purposes. Also, AERMOD does not appear to handle some specialized turbulence and flux measurements as well as is suggested in the user's manual. More recently, FRD also received a request to process Mesonet data and put it in formats suitable for Nuclear Regulatory Commission (NRC) models. This is part of a re-licensing effort for the Advanced Test Reactor. (Rick.Eckman@noaa.gov and Neil Hukari)

NOAA INL Weather Center Page

Our third-party link to display RSS feeds of NWS watch/warnings and FRD generated severe weather notices on our weather home page became increasingly slow over the past few months. This resulted in unacceptably long page load times. We have now created a module that will generate the RSS feeds in-house without going out to an external third party web site. As a result of this change, our weather web page loads in the blink of an eye. (Jason.Rich@noaa.gov)

OTHER ACTIVITIES

Outreach

An article was written for the Ask-a-Scientist section of the Idaho Falls Post Register newspaper during the quarter. Answers were provided to questions submitted by readers that included: 1) What percentage of a cloud is actually water? Or, what percentage of a rain cloud is dust and or other things? (Dennis.Finn@noaa.gov)

Kirk Clawson, Jason Rich and Donna Harris attended the 6th annual Ground Hog Day celebration at the Pocatello National Weather Service Forecast Office. Pocatello NWS uses this opportunity to showcase the latest and greatest software and displays being developed by the NWS to emergency managers throughout Eastern Idaho. Pocatello NWS is heavily involved in GIS displays of weather data using Google Earth. Through our established relationship we are sharing information and display tips.

Rick Eckman has continued to participate on the Ph.D. advisory committee for a student in the Department of Atmospheric Science, University of Wyoming. A committee meeting is scheduled for early April.

Papers

Kirk L. Clawson, NOAA/ARL, Idaho Falls, ID; and R. Eckman, T. Pierce, R. Carter, D. Finn, S. Perry, and V. Isakov, 2009: 2008 Roadway Sound Barrier Atmospheric Tracer Study. *Eighth Symposium on the Urban Environment, Special Symposium on Measurements in the Urban Environment and Observations*. Phoenix, AZ, Amer. Meteor. Soc., JP1.6.

Clawson, K.L., D. Finn, R.G. Carter, J.D. Rich, R.M. Eckman, S.G. Perry, V. Isakov, D.K. Heist, and T. Pierce, 2009: NOAA EPA Near-roadway Sound Barrier Atmospheric Tracer Study 2008. International Technical Meeting on Air Pollution Modeling and its Application, 30th NATO/SPS.

Clawson, K.L., R.M. Eckman, R.C. Johnson, R.G. Carter, D. Finn, J.D. Rich, N.F. Hukari, T. Strong, S. Beard, and B.R. Reese, 2009: Near Roadway Tracer Study 2008. NOAA Technical Memorandum ARL- (passed ARL review)

Finn, D., K.L. Clawson, R.G. Carter, J.D. Rich, R.M. Eckman, S.G. Perry, V. Isakov$_2$, and D.K. Heist, 2009: Tracer studies on the effects of roadside noise barriers on near-road pollutant dispersion in varying atmospheric stability conditions. (In ARL review)

Finn, D., K.L. Clawson, R.G. Carter, J.D. Rich, and C. Biltoft, 2009: Observations of Concentration Variability in Tracer Plumes in an Urban Boundary Layer with Considerations for Emergency Response. (Submitted to *Environmetrics*)

Safety

At the January staff meeting the staff reviewed "Driving Safety" video. In February we reviewed the video "Flammable Liquids" at the monthly staff meeting. During the March staff meeting FRD employees viewed the DVD "Working with Stress".

Training

The entire FRD staff completed the IT Security Awareness on-line course.

Donna Harris and Kirk Clawson completed the Government Ethics on-line course.

Kirk Clawson completed the on-line NOAA Personal Property Training course.

Donna Harris completed the USAccess PIV Sponsor training.

Travel

Kirk Clawson to Phoenix, AR, January 11-15, to present a poster and attend the AMS Annual Meeting.
Kirk Clawson to Arlington, VA, January 21-22, to discuss the potential for additional tracer studies at the Pentagon.

Kirk Clawson to Research Triangle Park, NC, January 23, to discuss the potential for additional roadside sound barrier tracer studies with the EPA.
Kirk Clawson to Oak Ridge, TN, February 10-13, to serve on the selection committee for the ATDD director.